

**Infrared Remote Sensing in the Presence of Clouds
Accuracy and Performance of AIRS-AMSU-HSB**

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Abstract: The Atmospheric Infrared Sounder (AIRS) is a facility instrument on the NASA Aqua mission. AIRS and its two companion instruments, the Advanced Microwave Sounding Unit (AMSU) and the Humidity Sounder for Brazil (HSB) were launched into Earth orbit on the NASA Aqua mission on May 4, 2002. The AIRS has 2378 infrared channels in the range of 3.7 - 15.4 microns with a nominal spectral resolution of 1200. The AIRS instrument represents a breakthrough in infrared space instrumentation. It incorporates numerous advances in infrared sensing technology to achieve a high level of measurements sensitivity, precision and accuracy. This includes a temperature controlled grating, long wavelength cutoff HgCdTe infrared detectors cooled by an active pulse tube cooler to 55K.

From the start, the AIRS Team placed a major emphasis on an integrated end-to-end instruments design and algorithm approach. All three elements of the system are cross-track scanning instruments with a fixed spin period of 8 seconds for AMSU-A and 8/3 seconds for AIRS and HSB. While AIRS and HSB have a nominal 1.1° field of view with near contiguous spatial sampling, AMSU-A has 3.3° field of view, also with near contiguous sampling. This scanning configuration meets the requirement of the AIRS cloud-clearing algorithm of grouping 9 AIRS and HSB footprints centered on a single AMSU-A footprint.

The AIRS-AMSU-HSB system is capable of eliminating the effects of clouds on the AIRS infrared radiances (spectrum) in the presence of up to 80% cloud opacity in the AIRS fields of view. From the resulting cloud-cleared spectrum we will achieve, worldwide, the same accuracy in temperature as currently possible only with direct measurements by balloon-borne sensors. For moisture, however, the accuracy of AIRS-AMSU-HSB will exceed that measured by balloon-borne sensors.

The AIRS-AMSU-HSB instrument suite on Aqua is designed to meet both the NOAA operational weather prediction requirements as well as NASA's climate

research needs. We expect the assimilation of AIRS data into forecasts models to result in major forecast improvements

The performance of AIRS since launch has been exceptional indicating that the AIRS-AMSU-HSB instrument suite will meet or exceed its objective. The system with nearly 2400 channels sensing different regions of the atmosphere will provide information on clouds, greenhouse gases in addition to temperature and humidity and many other weather and climate parameters:

Core Products: Global, Day- Night, Lands-Oceans

Infrared cloud-cleared Spectrum (Radiances)

Atmospheric temperature profiles - 1C/1km

Sea surface temperature: 0.5C

Land surface temperature: 1C

Infrared emissivity ratio

Relative humidity profiles: 20%/1 km

Total perceptible water vapor: 5%

Fractional cloud cover 0.05

Cloud-top pressure and temperature

Cloud spectral infrared emissivity ratio

Total ozone burden of the atmosphere

Research Products:

Total CO₂ burden of the atmosphere: 2ppm

CO and CH₄ profiles

Precipitation rates

Etc.

At the time of the conference we will have enough results to provide an assessment of the AIRS-AMSU HSB on-orbit performance, discuss major scientific findings and describe various types of data which will be available.